

Redox Reaction Practice Tutorial

Complete the following practice problems on a separate sheet of paper. Balance using the half - rxn method.

Acidic solution:

1. Assign oxidation numbers to determine what is oxidized and what is reduced, if no change in oxidation numbers occurs it is not a redox reaction and you must balance by inspection.
2. Write the oxidation and reduction half-reactions.
3. Balance each half-reaction.
 - a. Balance elements other than H and O.
 - b. Balance O by adding H₂O.
 - c. Balance H by adding H⁺.
 - d. Balance charge by adding electrons.
4. Multiply the half-rxn by integers so that the e⁻ gained and lost are the same.
5. Add the half-reactions, subtracting things that appear on both sides.
6. Make sure the equation is balanced according to mass and to charge.

In a Basic Solution:

Once the equation is balanced, add OH⁻ to each side to "neutralize" the H⁺ in the equation and create water in its place. H⁺ + OH⁻ → H₂O
If this produces water on both sides, you might have to subtract water from each side.

Example



Step 1: Find reduction and oxidation in species

As +3 to +5 Net Change = +2

N +5 to +2 Net Change = -3

Step 2: half Reactions

Reduction: $\text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g})$

Oxidation: $\text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq})$

Step 3: Balance each half-reaction

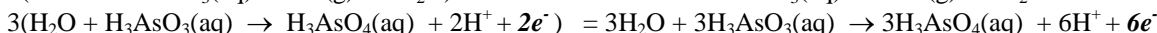
Reduction: $\text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g})$

- a. Balance elements other than H and O: $\text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g})$
- b. Balance O by adding H₂O: $\text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}$
- c. Balance H by adding H⁺. $3\text{H}^+ + \text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}$
- d. Balance charge by adding electrons. $3\text{e}^- + 3\text{H}^+ + \text{HNO}_3(\text{aq}) \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}$

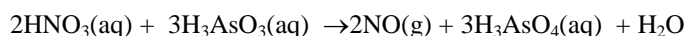
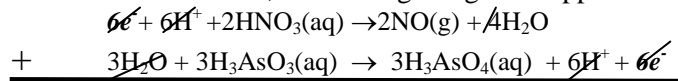
Oxidation: $\text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq})$

- a. Balance elements other than H and O: $\text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq})$
- b. Balance O by adding H₂O: $\text{H}_2\text{O} + \text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq})$
- c. Balance H by adding H⁺. $\text{H}_2\text{O} + \text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq}) + 2\text{H}^+$
- d. Balance charge by adding electrons. $\text{H}_2\text{O} + \text{H}_3\text{AsO}_3(\text{aq}) \rightarrow \text{H}_3\text{AsO}_4(\text{aq}) + 2\text{H}^+ + 2\text{e}^-$

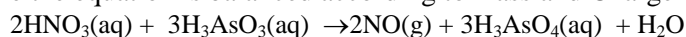
Step 4: Multiply the half-rxn by integers so e⁻ gained and lost are the same.



Step 5: Add the half-reactions, subtracting things that appear on both sides.



Step 6: Make sure the equation is balanced according to mass and Charge



Mass 501 g/mol = 501 g/mol

Charge 0 = 0

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1. $\text{MnO}_4^- + \text{H}^+ + \text{Br}^- \rightarrow \text{Mn}^{2+} + \text{Br}_2 + \text{H}_2\text{O}$
2. $\text{Cr}_2\text{O}_7^{2-} + \text{H}^+ + \text{I}^- \rightarrow \text{Cr}^{3+} + \text{I}_2 + \text{H}_2\text{O}$
3. $\text{MnO}_4^- + \text{SO}_3^{2-} + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{SO}_4^{2-} + \text{H}_2\text{O}$
4. $\text{Cr}_2\text{O}_7^{2-} + \text{Fe}^{2+} + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{Fe}^{3+} + \text{H}_2\text{O}$
5. $\text{I}^- + \text{H}^+ + \text{NO}_2^- \rightarrow \text{NO} + \text{H}_2\text{O} + \text{I}_2$
6. $\text{C}_2\text{H}_4 + \text{MnO}_4^- + \text{H}^+ \rightarrow \text{CO}_2 + \text{Mn}^{2+} + \text{H}_2\text{O}$
7. $\text{H}_2\text{S} + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Cr}^{3+} + \text{S} + \text{H}_2\text{O}$
8. $\text{MnO}_2 + \text{H}^+ + \text{NO}_2^- \rightarrow \text{NO}_3^- + \text{Mn}^{2+} + \text{H}_2\text{O}$
9. $\text{Cu} + \text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{Cu}^{2+} + \text{H}_2\text{O} + \text{SO}_2$
10. $\text{H}_2\text{SO}_4 + \text{C} \rightarrow \text{CO}_2 + \text{SO}_2 + \text{H}_2\text{O}$
11. $\text{Sn(OH)}_3^- + \text{Bi(OH)}_3 + \text{OH}^- \rightarrow \text{Sn(OH)}_6^{2-} + \text{Bi}$ (Basic)
12. $\text{Al} + \text{NO}_3^- + \text{OH}^- + \text{H}_2\text{O} \rightarrow \text{Al(OH)}_4^- + \text{NH}_3$ (Basic)
13. $\text{NO}_2 + \text{OH}^- \rightarrow \text{NO}_3^- + \text{NO}_2^- + \text{H}_2\text{O}$ (Basic)
14. $\text{MnO}_4^- + \text{H}_2\text{O} + \text{NO}_2^- \rightarrow \text{MnO}_2 + \text{NO}_3^- + \text{OH}^-$ (Basic)